FAA National Software Conference, June 2001
Adaptation Improvement Program

FAA
Software
Engineering
Resource
Center

Solving today's problems ...
Learning to prevent tomorrow's

Adaptation Improvement Program Introduction

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June 6, 2001

SERC Mission Overview

Mission

◊ Solve current and future problems

◊ Improve FAA workforce competency

◊ Apply SwE concepts across IPT's and functional organizations

- **Be an FAA-wide software engineering resource**
- **Leverage government, academic, and industry resources through inter-disciplinary teams to:**
  - **solve mission-critical problems**
  - **maintain a close watch on evolving technologies**
  - **extend the state of the practice of FAA Software Engineering (SwE)**
- **Provide Integrated Product Teams and other functional organizations access to world-class subject matter experts**
- **Focus on enterprise-wide "FAA" problems - not just project specific**
- **Key goal is to increase FAA SwE competencies (become intelligent software purchasers)**

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Changing Environment

- Hardware oriented ’60s and ’70s
  - Small apps, small or no OS, limited storage, assembly languages, unique interfaces
- Software oriented ’80s and ’90s
  - Large apps, multi-tasking OS, substantial storage, high level languages, standardized interfaces
- Adaptation oriented environment today
  - CAS apps with glue code, distributed processing, almost unlimited storage, write once – run anywhere languages, industry standard interfaces

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Changing Environment

- Future Vision
  - Focus on delivery of services instead of systems
  - Systems become virtual entities
  - Massive parallel processing
  - Wide-area distributed processing
  - Extensive Re-use libraries
  - Self-tuning or self-learning systems
  - Data assets are registered, defined, and traceable
  - Data standards are adopted
  - Knowledge Management

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Today's Approach

- Limit Hardware Configurations/Rev Levels
  - Scale to facility load
  - Minimize unique systems to support
- Single "National" Software Baseline
  - Contains superset of all required functionality
- Adapt the rest!
  - Site-specific items, user preferences, performance parameters, hardware and software parameters
  - Some program logic/rules moved to adaptation

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Adaptation Driving Factors

- Requirement for more accurate and precise data
  - Earth model used to precisely locate objects, not relative positions to NAS automation system plane
  - Digital maps must be aligned to automation system objects; not simple overlays that can be shifted
  - Mosaic and fusion radar trackers require uniform reference model; must work across facility boundaries
  - Reduces system "tweaking" and iterative rebuilds and system retest
  - Shifts burden to data owners to provide certified data

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Adaptation Driving Factors

- Adaptation data for new systems are generally more extensive and complex
  - ATC rules captured as adapted logic
  - "Correct" values can sometimes only be determined through long term data collection and statistical analysis, or by human observation
  - Can create an almost limitless set of test cases
  - Subjective tests must be used to validate data as satisfactory; absolute certification may not be possible; multiple satisfactory solutions may exist

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Adaptation Driving Factors

- Existing methods are cumbersome
  - Multiple sources of raw data from multiple databases
  - Data sometimes re-entered multiple times
  - Reliance on manual processes
  - Files are often delivered by package express companies
  - Some automation systems are "inheritors" of upstream "as adapted" data

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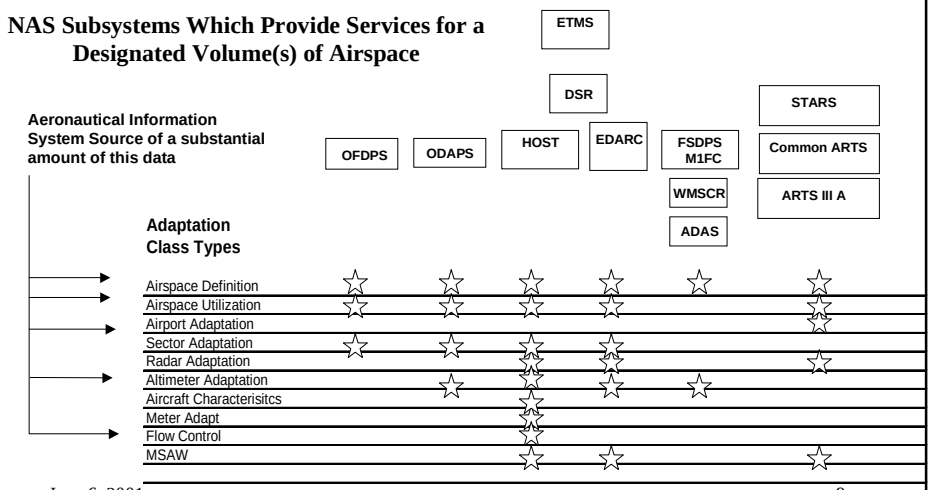
Our Systems Use the Same Subset of Base Data



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Framing the Adaptation Problem

- Growth in quantity and complexity of adaptation in new systems is challenging our ability to deploy, maintain, and afford
- Supportability issues are exacerbated by 56 day update cycles; never reach steady-state
- Sheer number of supported facilities is a huge multiplication factor

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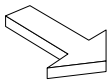
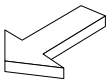
Adaptation Improvement Program (AIP)

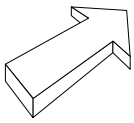
Improved Data
Ensure that required source data is readily available, current, accurate, and possesses sufficient precision.

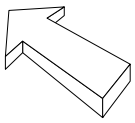
New Technology and Infrastructure
Develop a modern FAA adaptation environment that will enable process improvements.





***Program Goal**: Evolve NAS adaptation to support cost effective NAS performance growth and modernization*
***FY-2001 Objective**: Ensure the STARS adaptation process is as effective & efficient as possible*





Improved Processes
Redesign adaptation processes to take advantage of the improved adaptation environment.

Improved SOPs & LOAs
Develop new methods to create, access, and maintain agreements and procedures that are less ambiguous, and can be interpreted and translated into a computer readable form.

Improved Data (Future)

- All data assets are registered, defined, and configuration managed; validity can be traced to certified sources
- Data is captured electronically at source in standard formats for immediate “broad” distribution – write once and read many times
- Data is “pushed” to subscribers over broadband connections when it changes; is packaged for a specific user

Improved Processes (Future)

- Data stewards assume responsibility for CM and data quality (accuracy, precision, …)
- Requirements for new data items are managed at the NAS level
- Data access and tools are integrated together into the user work environment
- "Smart" tools analyze data (semi-)automatically for quality, trends, …

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Operational Directives (Future)

- ATC procedures captured in Letters of Agreement (LOA) and Standard Operating Procedures (SOP)
- Move to standardized LOA form construction across FAA facilities and regions
- Ensure that embedded "rules" can be extracted
- Conversion of LOAs and SOPs into a self-defining, computer interpretable form like an XML data stream

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Essential Technological Ingredients

- High speed Internet-based service delivery
- Standards-based authentication and encryption
- Platform independence
- Thin client, central server concept for our direct adaptation customers
- Agreed upon APIs and inter-system interfaces
- Distributed processing model serving widely disparate, geographically separated servers
- Re-engineered processes to capitalize on enabling technology

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NAS Adaptation Services Environment

- Will leverage commercial e-Business solutions
  - Extensible and robust foundation architecture
- Provide an open-system, centralized services environment
  - Eliminates distribution of application updates and fixes
  - Applications can be developed by anyone
- Single portal for adaptation support work
  - "One stop shopping" for NAS researchers, developers, and maintainers
  - Simplifies security solutions

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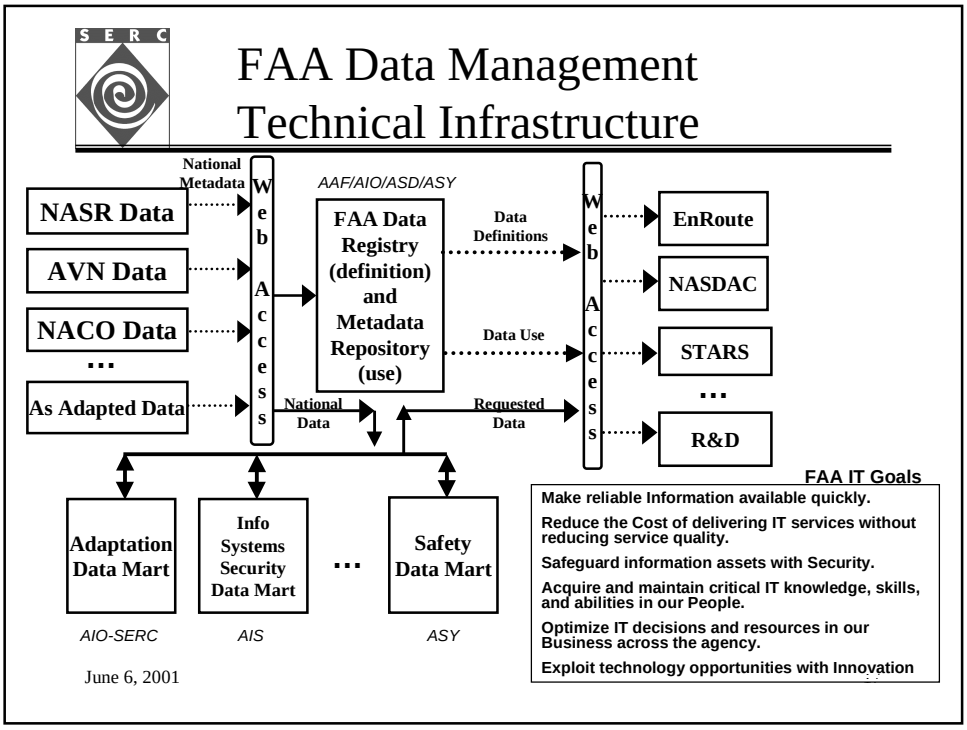
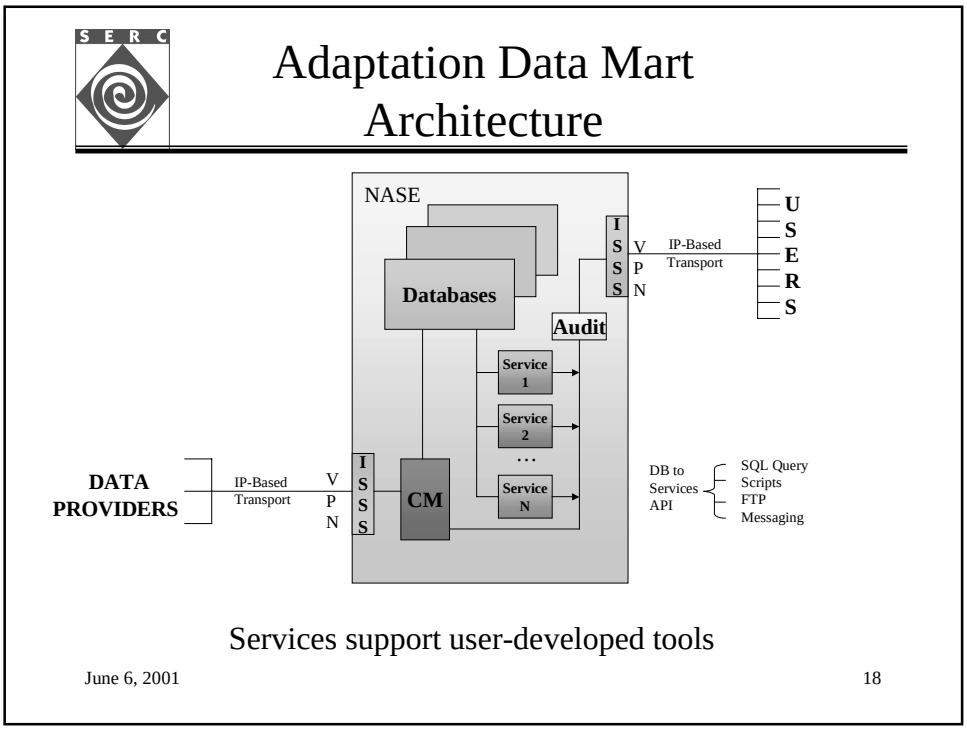
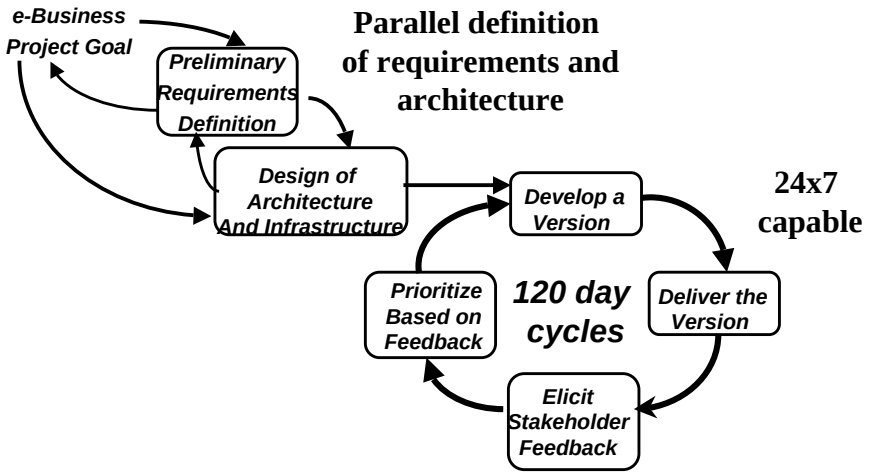




Evolutionary Delivery Process[1]



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1 McConnell, "Rapid Development", Microsoft Press

Summary

- AIP is an R&D project focused on providing short-term , ***production-quality*** solutions to pressing adaptation needs (in FY-2001 and 2002)
- Moves FAA towards the future vision
- "Static" data in the Adaptation Data Mart
- Evolutionary delivery process to get product to the field quickly and learn from the users
- "e-Business type" technical architecture

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